NASA/CR-96 - 206163

FINAL
IN-52-
6017.

Final Technical Report
Grant No. NAG 9-412
Dwain L. Eckberg, M.D.
February 26, 1996

P2

Four types of study were proposed. Most of the proposed research was completed. Most of the research results have been published as peer-reviewed articles, are in revision, or are in preparation.

1. Hypotension; vasovagal reactions.

Nineteen patients with histories of orthostatic vasovagal reactions were studied during passive 60^0 upright tilt. Eight experienced vasovagal reactions and nine did not. In fainters, muscle sympathetic nerve activity disappeared at the onset of the vasovagal reaction, and R-R intervals increased. This study is being prepared for publication:

> Morillo, C. A., K. A. Ellenbogen, L. A. Beightol, and D. L. Eckberg. Autonomic mechanisms during orthostatic vasovagal reactions. *N. Engl. J. Med* 1996.

Venous pooling was provoked by low level lower body suction (not venesection, as proposed) and thoracic aorta dimensions were measured by magnetic resonance imaging. The results showed that since even the lowest level of suction, 5 mmHg, reduced aortic cross-sectional area, arterial baroreceptors contribute to autonomic responses to modest venous pooling. This study was published:

> Taylor, J. A., J. R. Halliwill, T. E. Brown, J. Hayano, and D. L. Eckberg. 'Nonhypotensive' hypovolaemia reduces ascending aortic dimensions in humans. *J. Physiol. Lond.* 483: 289-298, 1995.

2. Control of respiratory parameters.

Power spectral analyses of R-R intervals were performed at constant tidal volumes at different breathing frequencies. This study, which underscores the importance of respiratory control when autonomic outflow is being gauged, was published:

> Brown, T. E., L. A. Beightol, J. Koh, and D. L. Eckberg. The important influence of respiration on R-R interval power spectra is largely ignored. *J. Appl. Physiol.* 75: 2310-2317, 1993.

The contributions of respiratory motoneuron activity to respiratory sinus arrhythmia were evaluated in healthy subjects. Subjects breathed at a constant rate and tidal volume, with three different resistances, at three different arterial pressures, and the results were analyzed with a three stage linear regression model. The results, which document great complexity in mechanisms governing human sinus arrhythmia, are in revision.

Gonschorek, A. S., J. R. Halliwill, D. L. Eckberg, L. A. Beightol, J. A. Taylor, I.-L. Lu, J. A. Painter, and H. Warzel. Human autonomic rhythms: interactions among peripheral and central influences that govern neural cardiovascular outflow. *Am. J. Physiol.* 1996.

Contributions of pulmonary and thoracic stretch receptors to respiratory sinus arrhythmia were studied in patients undergoing elective orthopedic. These subjects breathed spontaneously, or were ventilated by conventional positive pressure mechanical ventilation or high frequency jet ventilation. The principal finding of this study is that afferent input from pulmonary and thoracic stretch receptors makes a very small, but significant contribution to respiratory sinus arrhythmia. This study is in revision.

Koh, J., T. E. Brown, L. A. Beightol, and D. L. Eckberg. Contributions of lung inflation to R-R interval and arterial pressure fluctuations. *Anesthesiol.* 1995.

3. Autonomic outflow in patients with spinal injuries.

Power spectral analyses of R-R intervals and arterial pressure were made at different levels of arterial pressure in healthy volunteers and tetraplegic patients. The results document the presence of low frequency (about 0.1 Hz) R-R interval and arterial pressure rhythms in tetraplegic patients. These results, which support the possibility that low frequency human rhythms originate in spinal sympathetic motoneurons, were published.

Koh, J., T. E. Brown, L. A. Beightol, C. Y. Ha, and D. L. Eckberg. Human autonomic rhythms: vagal cardiac mechanisms in tetraplegic subjects. *J. Physiol. Lond.* 474: 483-495, 1994.